

taken 78 eggs. I had hoped to have got the nests of the Great Indian Stone-Plover, the Little Tern (*Sterna sinensis*), and the Ringed Plover (*Ægialitis dubia*); but the first two species had apparently not yet laid, and I did not see a single specimen of the third. On the whole, for my first attempt, I was more than satisfied, and my only wish is that I may enjoy many another day's hunting by Ganga's sacred stream. It does not become a tyro to make remarks on a single day's experiences, but I think it may be of interest to point out that, whereas Mr. Hume seems to have found mostly young birds after the third week in March in the Etawah district, a large number of my eggs were quite fresh on April 9th, although Fatchgarh is east of Etawah, and I did not see the sign of a young one on the many islands which I visited.

The following is the list of eggs taken:—

<i>Hoplopterus ventralis</i>	17	.....	average (14)	1.61 × 1.12
<i>Glareola lactea</i>	44	.....	„ (34)	1.03 × 0.86
<i>Sterna seena</i>	3	.....	„	1.67 × 1.23
— <i>melanogaster</i>	9	.....	„	1.35 × 1.00
<i>Rhynchops albicollis</i>	5	.....	„	1.58 × 1.17

Note.—Since writing this I have seen the 4th vol. of the ‘Birds of India and Burmah,’ and notice that no native name is given to the Terns.

In Oudh and the North-west Provinces I have always heard them called “Titri” by the boatmen, except *R. albicollis*, which is “Pancheera.”

This Titri is not to be confounded with Titiri (pron. *titeeree*), the generic name for the Plovers.—W. J.

III.—On the Habits of the Mound-building Birds of Australia.

By D. LE SOUËF, C.M.Z.S., Melbourne.

MOUND-BUILDING birds are always a subject of interest; they are widely dispersed over the continent of Australia, and are likely to hold their own for a long time to come, for as a rule they inhabit country which can with difficulty be

turned to any practical account, such as the dry sands of the South and the densely-timbered coastal ranges of the North. All the Australian species make their mounds of different material and in a different way, and I will now give a few details of the habits of each of them, based on information obtained from practical observation.

1. THE MALLEE-FOWL (*Lipoa ocellata*).

This bird has an extensive range in the southern half of Australia, being found in the north-western portion of



Half-finished Mound of the Mallee-Fowl.

Victoria, south-western portion of New South Wales, Southern South Australia, and Western Australia. It is, practically speaking, found wherever the mallee (a dwarf eucalyptus) grows, and hence the name of the bird, as it is

always associated with the mallee or similar scrub. The country where this tree grows is mostly sandy and has a small rainfall, often being intersected with sandy ridges, popularly called pine-ridges, from the fact that the Murray pine generally grows on them.

The male and female birds differ very little in markings, and their mottled black-and-grey colour harmonizes wonderfully with their surroundings. As they are shy and solitary, they are rarely seen, but specimens are sometimes obtained by patient watching near their nesting-mound. They occasionally utter a low soft note, and their gait when undisturbed is a slow walk, although they can run fast if necessary. Their food consists of insects, berries, and the buds of a small shrub. They go to roost in trees when it is almost dark.

The nesting-mound of these birds is generally situated close to some pine-trees or with thick scrub near or round it, and rarely without cover being near. When the scrub has been cut down round their old nesting-place they leave it and form another, but they prefer to make up their old mounds if possible, and the same places are often used year after year. When the birds have selected a site, they scrape out a slight hollow in the ground, from 6 to 8 inches deep in the centre and about 2 feet wide. Next they scrape up leaves, bits of bark, twigs, and other vegetation that may be lying about, and put enough on, not only to fill the depression, but to make a small mound of it, about 8 inches or more above the level of the surrounding ground. They then form a hollow in the centre of the vegetation about one foot wide and 6 inches or more deep, this being the egg-chamber; after which they scrape sand all round the nest and leave it until rain comes and well wets the vegetation. The sand is then spread well over the mound to a depth of about 6 inches, and after a few days, when the vegetation has heated, the mound is ready for eggs. The nest is generally made in July or August and the first eggs are laid towards the end of September, but the absence of the necessary rain sometimes makes it later. Both birds assist in making the mound. The

sand is scraped together with both the feet and the wings, the latter being used especially when getting the sand well up on the mound, which, when finished, often measures at the base 12 feet in diameter and in the centre from 2 to 4 feet high, and as the sand is generally dry and runs freely, it is no easy matter for the birds to heap it up as they do. The various measurements given are about the average, as they differ more or less in every mound. The nest being ready for eggs, the hen bird scrapes out most of the sand from the egg-cavity, and, leaving about 2 inches of it at the bottom, she then lays her egg, and holding it upright with one foot, with the small end downwards, she scrapes the sand round it with the other foot until it can stand alone. The bird has to lean well back to enable her to use both her feet. She then covers the whole over with sand. The egg-cavity has to be scraped out and refilled every time an egg is laid, giving much work to the parent birds. The eggs are generally placed at the outer edge of the chamber and one often in the centre. The first eggs are covered up with about two inches of sand over them, and a second tier commenced, each egg being laid opposite the interspaces of the lower lot. There are generally three tiers, with from three to five eggs in each, and a full clutch is about 14. I have always found the temperature of the egg-cavity to be from 95° to 96° . The eggs are laid at daybreak on every third day, and incubation takes a little over five weeks. As incubation starts as soon as the egg is laid, the young ones are ready to hatch at different times. The eggs are usually of a delicate pink-colour, especially when first laid, but the pink colouring-matter easily comes off, especially after the egg has been taken out of the nest for some little time, and leaves the white under-surface exposed; occasionally I have found all the eggs in one mound pure white. The shell is very fragile, and one reason why the eggs are placed on end is evidently to sustain the weight of sand with which they are covered; the sand round the eggs is generally slightly damp. Sometimes, when the parent bird is opening up the mound, she scratches a hole in the top of one of the eggs,

the sand then gets in, and, mixing with the contents, forms, when dry, a compact sandy mass, completely filling the shell ; on one occasion I found five such eggs in one mound.

There has been much discussion as to whether the young birds can make their own way out of the soil unaided by their parents. In order to settle it I covered in with wire netting a nest with several eggs in it, so that the parents could not open it up, and found all the chickens, when they came to maturity, dead in their shells. Then again, on taking the eggs from a nest, you often find chickens in their eggs which are ready to hatch, especially in the lower tier ; so much so that, when opening the egg, you have to hold the young bird firmly to prevent it from escaping and running away. Then on other occasions you find chickens near the surface under the sand, apparently working their way out unaided. The old birds open up the nest to a certain extent daily at daybreak, and it is probable that any chickens that may be ready to come out, especially in the lower tiers, do so then. Moving the sand also prevents it from becoming set. But the chickens that hatch from the eggs of the top tier, the sand there not being set so tightly and being drier and running more freely, are able to force their own way out, and, judging from the experiments I have made, I should say this was usually the case. On opening up the nest that had been wired in, I found that the sand had set rather tight, especially where the eggs were, and this I should say fully accounted for the young birds being unable to come out.

When the mound is opened up during the day and eggs abstracted, the parent birds repair the mound shortly after the intruder has gone away, showing that either one or other of the birds generally remains in the neighbourhood.

When the young are hatched they are well able to take care of themselves, being strong and well developed, and their wing-feathers sufficiently formed to enable them to fly a short distance ; but they trust almost entirely to their running and hiding to escape danger, and to catch a newly-hatched young one in the scrub is no easy matter. The parent birds seem to take very little notice of their young,

which lead an independent existence from their birth. Most of the Mallees in captivity have been taken out of the egg, and they thrive well and are easily reared and kept, but do not, so far as I know, attempt to make a mound in confinement. Water is apparently not necessary for them, and in the dry country in which they live they must often have to go for months without any, but the same remark also applies to many other birds.

2. LATHAM'S BRUSH-TURKEY (*Catheturus lathamii*).

The Brush-Turkey is found on the north-east coast of Australia, from the Clarence-River district in New South Wales to Cape York in Queensland, and extends for a considerable distance inland. It is invariably met with in thick scrubby country, and prefers the higher lands, especially in the coastal districts of North Queensland, where you find the Brush-Turkeys inhabiting the hills and the Scrub-Fowl (*Megapodius duperreyi*) the low-lying country.

These birds are not often seen, being solitary and shy; run fast, but fly heavily, and with the aid of a dog can be easily made to take refuge on the lower limb of a tree, whence they go upwards from branch to branch until high enough to fly off above and clear of the scrub. The sexes are of the same colour, but during the breeding-season the male has a reddish-yellow wattle hanging from his neck, which he can apparently inflate at will; the female has no wattle. They are generally silent, but during the nesting-season the male, when at the mound, often makes a hoarse kind of call, and also when roosting in the evening. Their food consists of insects and berries, and at night they roost as high on the scrub-trees as they can get.

They make their mounds in the dense scrub anywhere, either on the level surface or on the side of a hill; when at the latter place they scrape the material for the mound from the upper side only. The same site is used year after year, but the mound is entirely remade, and is composed largely of leaves and twigs, with comparatively little soil, consequently very little of the mound is left when the next nesting-season

comes round. The birds scrape together the surface-leaves and other stuff which form the mound without previously preparing the ground, and the male bird does nearly all the work, Not only so, but when the mound is finished he is always near at hand, walking over and adding to it, and seems to constitute himself sole guardian. The mounds vary in size, but average about 3 feet 6 inches high in the centre and 10 feet in diameter at the base. They are generally made up early in September, and the birds commence laying in October or early in November. The leaves are scraped together during damp weather to cause them to heat, and the large powerful claws of the birds enable them to do this very quickly.

When the mound is sufficiently heated for eggs, the hen bird scrapes a hole in it on one side near the top, from a foot to 18 inches deep, and, laying her egg in it, places it on end with the small end down and then covers it up; but while she is on the mound the male bird vigorously beats her, apparently trying to drive her off, and on one occasion, in confinement, to my knowledge, killing her.

The temperature of the mound where the eggs are is about 95° or 96°; the egg is laid early in the morning and every third day, and a clutch consists of from 12 to 16 eggs. These are pure white, granulated, and rather fragile, and are generally placed irregularly round the top of the mound. During dry weather the birds add much vegetation to their structure, evidently to keep the material round the eggs from becoming too dry, but in wet weather they scrape it off again. The time of incubation is about six weeks. The young, when hatched, make their own way out, and do not need any assistance from their parents, but are able to fly and take care of themselves, leading a more or less solitary existence.

The male bird soon repairs any damage that may have been done to the mound, and a single pair of birds use one mound, but occasionally another hen will lay her eggs in it. The young when hatched are of a dark brown colour and difficult to detect in the scrub; they grow quickly, and in nine months are barely distinguishable from their parents.

They are easily kept in confinement, but, being very pugnacious, the males have to be separated when the nesting-season comes on. Two years ago, in the Melbourne Zoological Gardens, there were several of these birds in one enclosure. They made a mound, but had not enough vegetation in it to cause sufficient heat to hatch the 56 eggs that were laid, consequently these were all addled. Last season only a pair were left in, and I had the mound made up for them, and when one bird had finished laying I had another put in; she also laid in the mound, one bird laying 12 eggs and the other 13. Seventeen young were hatched and made their own way out; 16 of these were reared to maturity, and one died immediately on escaping from the mound. The other eight eggs were addled.

3. BARNARD'S BRUSH-TURKEY (*Cathetus purpureicollis**).

This bird differs considerably in the coloration of the neck of the male bird from the *Cathetus lathamii*, but its habits are practically the same. It is found in Cape York only, and has not the extensive range of its congener.

Mr. H. G. Barnard states that during the time of his visit to Cape York in October, November, December, and January, the season having been exceptionally dry and very little rain having fallen, hardly any of the birds laid, and the many mounds he tried were all empty. He found only one egg, and that in January, showing how much weather affects birds nesting.

4. DUPERREY'S SCRUB-FOWL (*Megapodius duperryi*).

These birds are found on the north-east coast of Queensland, always inhabiting the densest scrub, and never very far from the coast, and in the low-lying country on each side of many of the tidal rivers for a short distance inland. They are also found on many of the small scrub-covered islands of the coast, and although the birds are very poor fliers, they must have winged their way out to the islands somehow, as in many cases they are situated a good

* *Talegallus purpureicollis*, Le Souëf, Ibis, 1898, p. 51.

many miles from the mainland. It is possible they may have been blown out during a cyclone. The want of water on many of these islands does not seem to make any difference to them.

The male and female are very similar in appearance, being of a dark brown colour, the male being the darker of the two. They are difficult to detect in the scrub, especially when they remain quiet, which they often do on being first disturbed. Their habits are shy and solitary, and they are rarely seen, as, on being alarmed, they can run very quickly, keeping in the thickest cover, or else they fly into a low branch of a tree, and on perceiving any movement on the part of the cause of their disturbance they fly heavily away. They use their wings much more readily than the Brush-Turkey, and fly more freely through the scrub.

They are generally very silent during the day, but when they are going to roost near the tops of the high trees they often utter a loud double call, and frequently repeat it all night at intervals of half an hour or so. When camped in the scrub I have often heard them. Their food consists of snails, insects, berries, &c.

The Scrub-hens generally make their mounds in thick scrub, and apparently without any particular choice of locality; they are often placed just above high-water mark on the coast, and of course are then mostly composed of sand mixed with stones, roots, sticks, and leaves, while further inland earth takes the place of sand. But, unlike the Maillee-Fowl or Brush-Turkey, they form their mounds mostly of soil, with just sufficient vegetation mixed with it to cause it to heat. Again, they do not scrape out their mounds every season, but add to them, so that, as they are largely composed of soil, in the course of a few years they become of considerable size, and shrubs and trees often grow on them, and in course of time fill them with a network of roots. By that time, however, the birds generally desert them, not so much on account of the roots, but because the vegetation has become decomposed and no longer generates sufficient heat. When a pair of birds start a nesting-mound

it is often very small the first year, about 2 feet high and 5 feet in diameter at the base, and you find mounds from that size up to 14 feet high and 35 feet in diameter at the base.

The birds generally make the top portion of the mound up and add to it in July and August, apparently to let sufficient moisture penetrate before they commence laying towards the end of September or early in October, in a wet season earlier, in a dry season later. The surface is scraped for a considerable distance round the mound, holes often being made from which they take the soil.

The temperature of the part of the mound where the eggs are placed is generally 95° , occasionally a little over, and a clutch is nine eggs, that being the largest number I have known to be taken out of one nest. So far as I can judge, only one pair of birds use the same mound, and the male is generally near at hand to repair any damage that may have been done. When the hen bird is ready to lay she scrapes a hole near the top of the mound to the depth of from 6 inches to 5 feet, and the egg having been laid in the hole she places it on end, with the small end downward, and covers it up to the level of the rest of the mound. Occasionally she makes an excavation straight in from the side, but not often. The various holes are not placed in any particular order, nor are they all of one depth. The egg is laid at daybreak, and three days elapse between the laying of each egg and the next. The egg being so large compared with the size of the bird will quite account for the time between the layings. The white shell of the egg is covered with a pink substance, which easily flakes off when the egg is dry. The eggs are about the same size and colour as those of the Mallee-Fowl, so much so that the eggs of one bird can easily be mistaken for those of the other. Incubation takes about six weeks, and the young when hatched make their own way out, as the parent birds, by frequently scratching, prevent the soil from becoming caked and hard. Only one egg is laid in each excavation, and the holes are about a foot in diameter; sometimes they go down straight

and sometimes at an angle. In a moist neighbourhood the eggs are not so far from the surface as they are in the drier sandy soil.

The young when hatched are well feathered and can fly, and at once commence an independent existence, as they do not stay with their parents. Scrub-fowls are difficult to keep in confinement, being very restless, and generally end by accidentally killing themselves. Consequently adult birds of this species are rarely seen in captivity.

IV.—*On the Comparative Ages to which Birds live.*

By J. H. GURNEY, F.Z.S.

How many things there are in ornithology, in spite of our boasted proficiency at the present day, of which we are really profoundly ignorant! And one of these is the age of birds. Who can say what guides birds on migration, in spite of all which has been written on the subject—whether any of them have the power of smelling—what their powers of vision are, or even what becomes of them when they are dead?

There is still much difference of opinion as to whether many species moult the major part of their plumage or recolour, and the best ornithologists are divided as to the height at which birds migrate, the speed at which they go, and the age to which they can, under the most favourable conditions, live, which is the subject of the present paper. No one, up to now, has been at the pains to collect and compare the facts about age scattered in many books, but I hope to make at least a step in that direction. Birds are not to be compared to human beings. They are in truth handicapped in the race for life, for it is ordained that all the feathered tribes should be very much exposed to death from a great many accidental causes. We may so call death from insufficiency of food (oftenest arising from the extremes of heat and frost), from ravenous Hawks and other predaceous animals, and from the hand of man with his gun and snare. Almost every species of bird migrates, and they have to reckon on storms during